FIG. 1

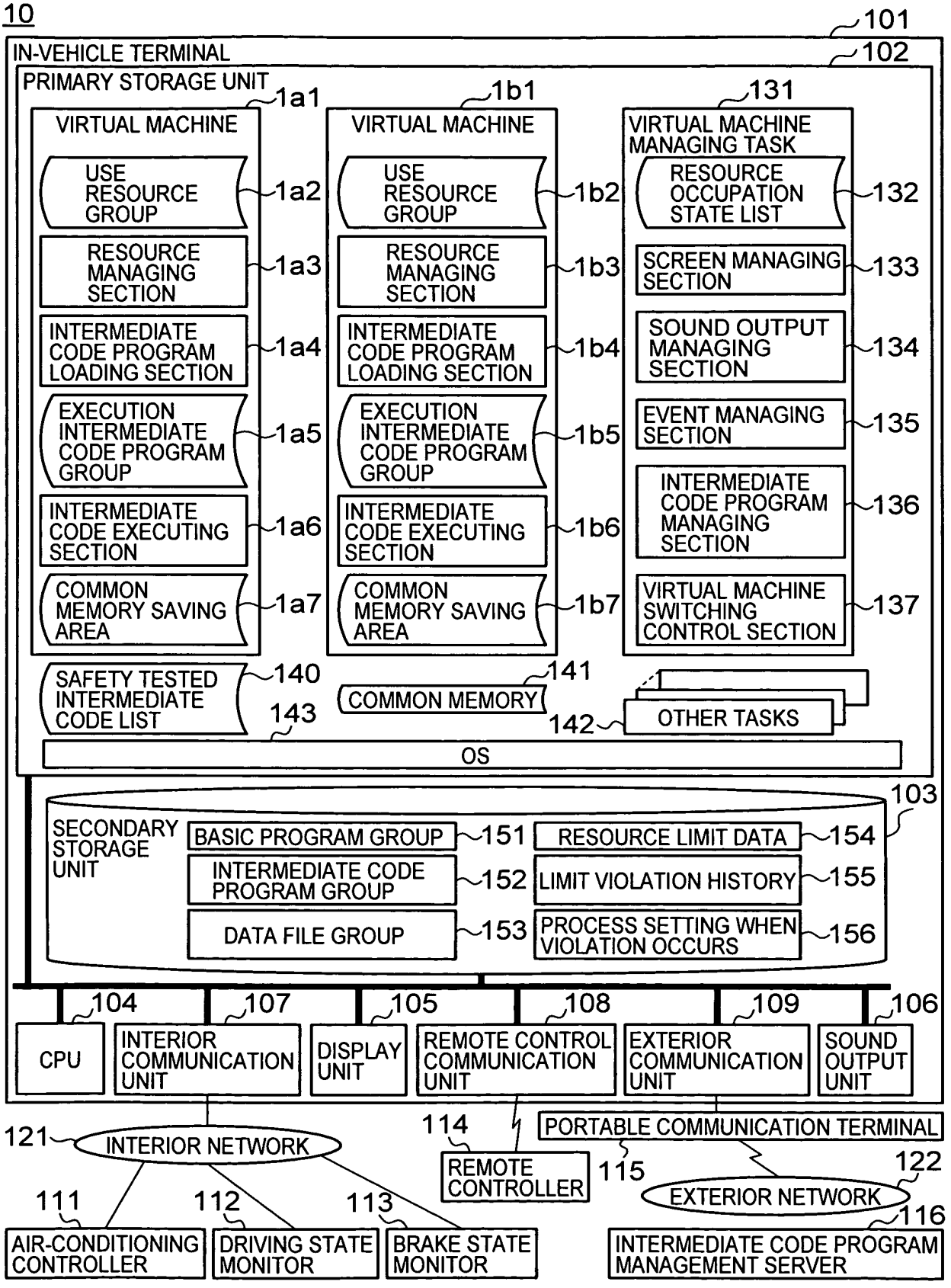

10
101
IN-VEHICLE TERMINAL
102
PRIMARY STORAGE UNIT
1a1
VIRTUAL MACHINE
USE RESOURCE GROUP
1a2
RESOURCE MANAGING SECTION
1a3
INTERMEDIATE CODE PROGRAM LOADING SECTION
1a4
EXECUTION INTERMEDIATE CODE PROGRAM GROUP
1a5
INTERMEDIATE CODE EXECUTING SECTION
1a6
COMMON MEMORY SAVING AREA
1a7
1b1
VIRTUAL MACHINE
USE RESOURCE GROUP
1b2
RESOURCE MANAGING SECTION
1b3
INTERMEDIATE CODE PROGRAM LOADING SECTION
1b4
EXECUTION INTERMEDIATE CODE PROGRAM GROUP
1b5
INTERMEDIATE CODE EXECUTING SECTION
1b6
COMMON MEMORY SAVING AREA
1b7
131
VIRTUAL MACHINE MANAGING TASK
RESOURCE OCCUPATION STATE LIST
132
SCREEN MANAGING SECTION
133
SOUND OUTPUT MANAGING SECTION
134
EVENT MANAGING SECTION
135
INTERMEDIATE CODE PROGRAM MANAGING SECTION
136
VIRTUAL MACHINE SWITCHING CONTROL SECTION
137
SAFETY TESTED INTERMEDIATE CODE LIST
140
143
COMMON MEMORY
141
142
OTHER TASKS
OS
103
SECONDARY STORAGE UNIT
BASIC PROGRAM GROUP
151
INTERMEDIATE CODE PROGRAM GROUP
152
DATA FILE GROUP
153
RESOURCE LIMIT DATA
154
LIMIT VIOLATION HISTORY
155
PROCESS SETTING WHEN VIOLATION OCCURS
156
104
CPU
107
INTERIOR COMMUNICATION UNIT
105
DISPLAY UNIT
108
REMOTE CONTROL COMMUNICATION UNIT
109
EXTERIOR COMMUNICATION UNIT
106
SOUND OUTPUT UNIT
121
INTERIOR NETWORK
111
AIR-CONDITIONING CONTROLLER
112
DRIVING STATE MONITOR
113
BRAKE STATE MONITOR
114
REMOTE CONTROLLER
PORTABLE COMMUNICATION TERMINAL
115
122
EXTERIOR NETWORK
116
INTERMEDIATE CODE PROGRAM MANAGEMENT SERVER

FIG. 2

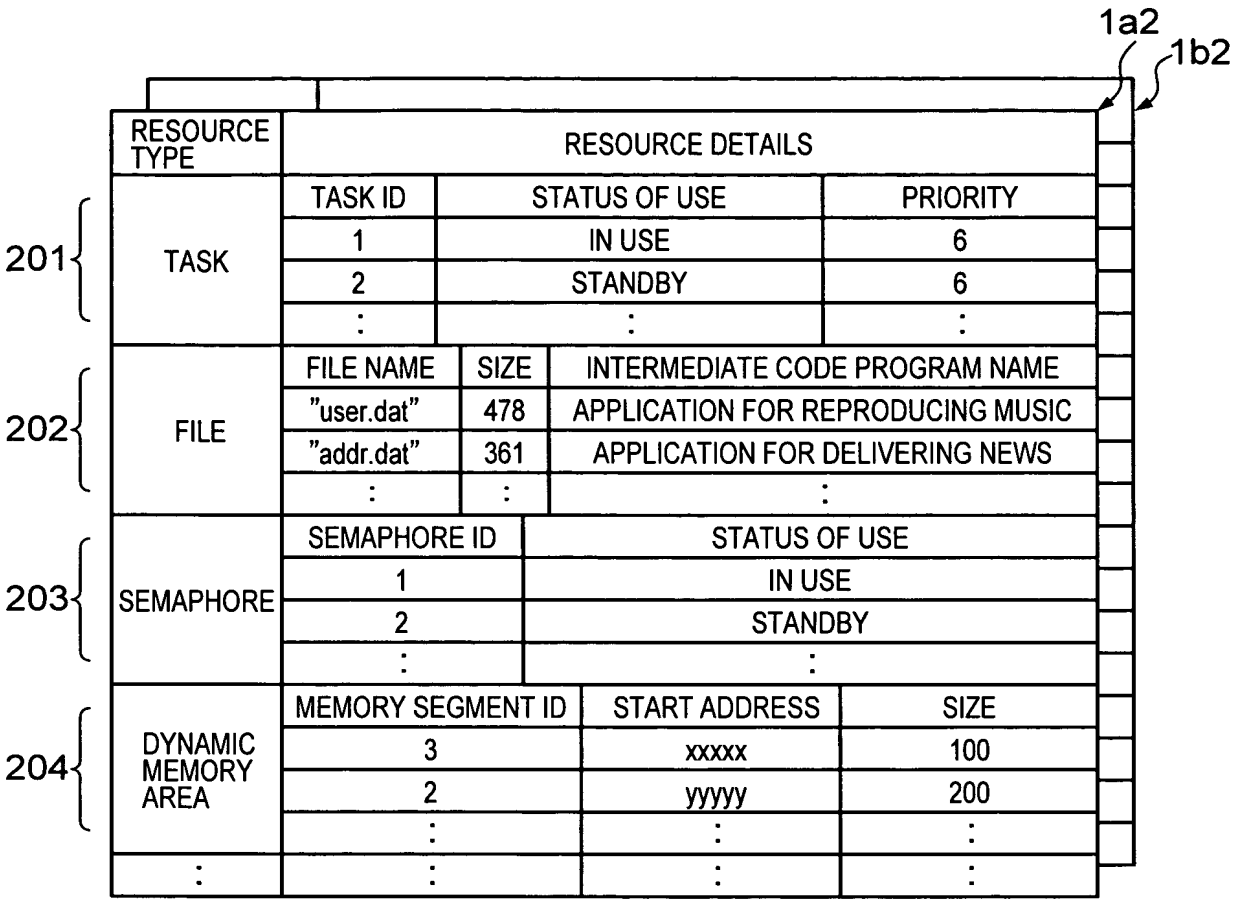


FIG. 3

132

1320 1321

RESOURCE TYPE	OCCUPYING VIRTUAL MACHINE ID
SCREEN	aaa
REMOTE CONTROLLER	NONE (DRIVING STATE)
SOUND SOURCE	bbb
CPU	aaa
:	:

FIG. 4

140

1400 INTERMEDIATE CODE PROGRAM NAME	1401 INTERMEDIATE CODE STRING NAME	1402 VIRTUAL MACHINE ID CONDUCTED A TEST
AIR-CONDITIONING CONTROL APPLICATION	OBTAIN VEHICLE BODY TEMPERATURE	aaa
NAVIGATION APPLICATION	MAKE A SEARCH OF NEARBY SHOPS	aaa
:	:	:
NEWS DELIVERY APPLICATION	OBTAIN THE LATEST INFORMATION	bbb

FIG. 5

154

1540 APPLIED VIRTUAL MACHINE ID	1541 RESOURCE TYPE	1542 LIMIT VALUE
aaa	NUMBER OF CREATABLE TASKS	32 UNITS
	NUMBER OF CREATABLE FILES	128 UNITS
	MAXIMUM CREATABLE FILE SIZE	2048kbyte
	NUMBER OF CREATABLE SEMAPHORES	16 UNITS
	SECURABLE DYNAMIC MEMORY SIZE	256kbyte
	CPU OCCUPATION RATE	70%
	:	:
bbb	NUMBER OF CREATABLE TASKS	16 UNITS
	NUMBER OF CREATABLE FILES	64 UNITS
	MAXIMUM CREATABLE FILE SIZE	512kbyte
	NUMBER OF CREATABLE SEMAPHORES	8 UNITS
	SECURABLE DYNAMIC MEMORY SIZE	64kbyte
	CPU OCCUPATION RATE	30%
	:	:

FIG. 6

155

1550 VIOLATION DATE AND TIME	1551 VIRTUAL MACHINE ID	1552 INTERMEDIATE CODE PROGRAM NAME	1553 LIMIT VALUE BEING VIOLATED	1554 VOLUME BEING VIOLATED
2000/1/4 23:25	bbb	APPLICATION FOR REPRODUCING MUSIC	LIMIT VALUE OF MEMORY DYNAMICALLY RESERVED	32byte
2000/3/4 12:09	bbb	APPLICATION FOR REPRODUCING MUSIC	LIMIT VALUE OF TOTAL SIZE OF CREATION AVAILABLE OBJECT	16byte
2000/4/4 18:11	aaa	APPLICATION FOR CONTROLLING AIR-CONDITIONING	LIMIT VALUE OF MEMORY DYNAMICALLY RESERVED	24byte
2000/4/13 09:56	bbb	APPLICATION FOR REPRODUCING MUSIC	LIMIT VALUE OF MEMORY DYNAMICALLY RESERVED	512byte
2000/4/16 11:04	bbb	APPLICATION FOR NEWS DELIVERY	LIMIT VALUE OF MEMORY DYNAMICALLY RESERVED	ONE UNIT
:	:	:	:	:

FIG. 7

156

1560 APPLIED VIRTUAL MACHINE ID	RESOURCE TYPE	1561 VIOLATION COUNT	1562 SUSPEND VIRTUAL MACHINE	1563 TERMINATE VIRTUAL MACHINE	DELETE INTERMEDIATE CODE STRING	NOTIFICATION TO SUPPLIER	CHANGE OF CPU OCCUPATION RATE
aaa	NUMBER OF CREATABLE TASKS	3	○	○	–	○	–
	NUMBER OF CREATABLE FILES	3	○	○	–	○	–
	MAXIMUM CREATABLE FILE SIZE	1	–	–	–	–	–10%
		10	○	–	○	○	–
	SECURABLE DYNAMIC MEMORY SIZE	5	○	○	○	○	–
	:	:	:	:	:	:	:
bbb	NUMBER OF CREATABLE TASKS	3	○	○	–	○	–
	NUMBER OF CREATABLE FILES	3	○	○	○	○	–
	MAXIMUM CREATABLE FILE SIZE	1	–	–	–	○	–10%
		10	○	○	○	○	–
	SECURABLE DYNAMIC MEMORY SIZE	5	○	○	○	○	–
	:	:	:	:	:	:	:

FIG. 8

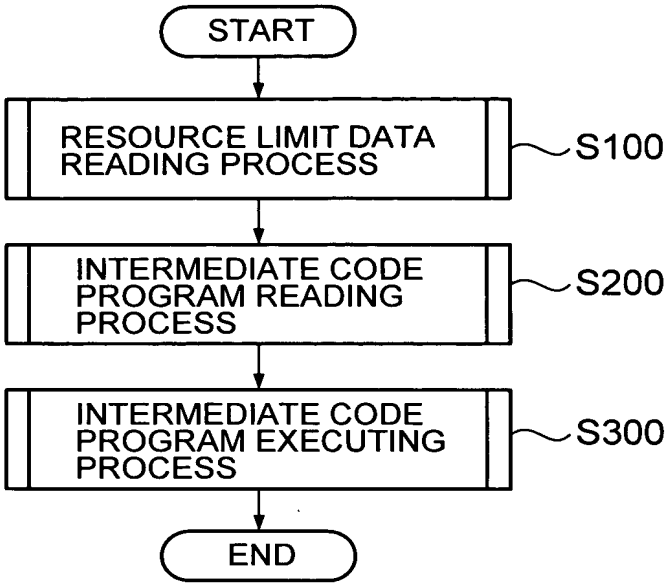

START
RESOURCE LIMIT DATA READING PROCESS
S100
INTERMEDIATE CODE PROGRAM READING PROCESS
S200
INTERMEDIATE CODE PROGRAM EXECUTING PROCESS
S300
END

FIG. 9

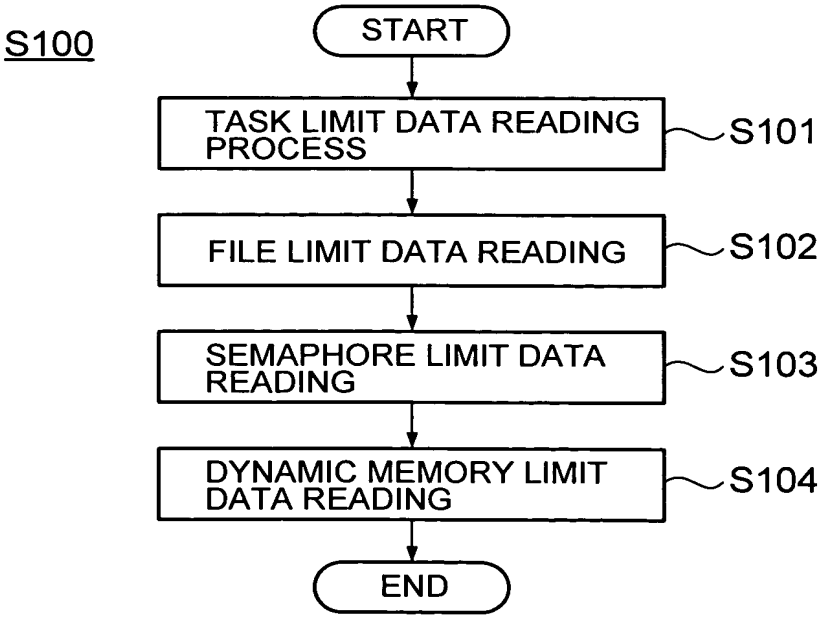

S100
START
TASK LIMIT DATA READING PROCESS
S101
FILE LIMIT DATA READING
S102
SEMAPHORE LIMIT DATA READING
S103
DYNAMIC MEMORY LIMIT DATA READING
S104
END

FIG. 10

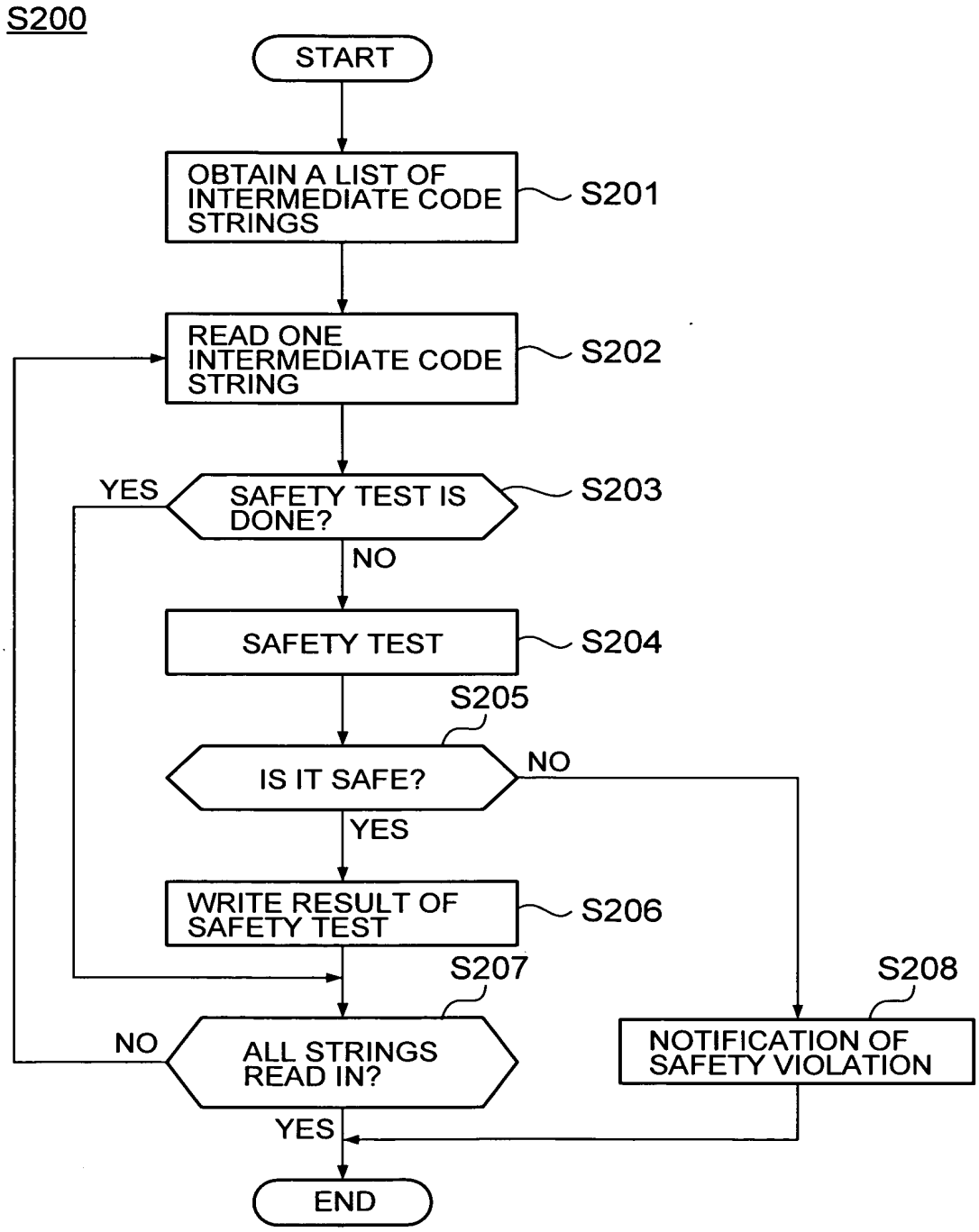

S200
START
OBTAIN A LIST OF INTERMEDIATE CODE STRINGS
S201
READ ONE INTERMEDIATE CODE STRING
S202
YES
SAFETY TEST IS DONE?
S203
NO
SAFETY TEST
S204
S205
IS IT SAFE?
NO
YES
WRITE RESULT OF SAFETY TEST
S206
S207
S208
NO
ALL STRINGS READ IN?
NOTIFICATION OF SAFETY VIOLATION
YES
END

FIG. 11

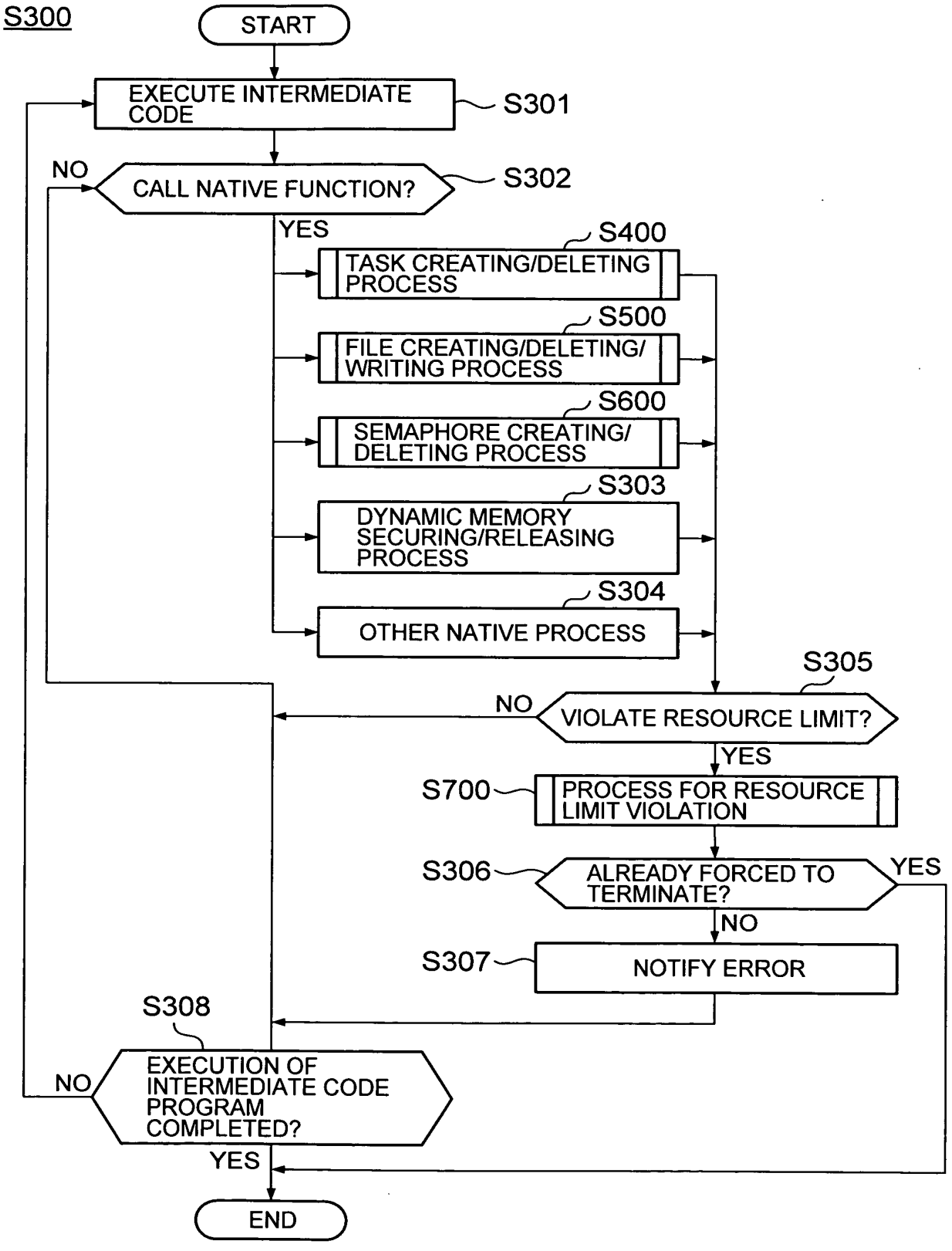

S300
START
EXECUTE INTERMEDIATE CODE
S301
NO
CALL NATIVE FUNCTION?
S302
YES
S400
TASK CREATING/DELETING PROCESS
S500
FILE CREATING/DELETING/ WRITING PROCESS
S600
SEMAPHORE CREATING/ DELETING PROCESS
S303
DYNAMIC MEMORY SECURING/RELEASING PROCESS
S304
OTHER NATIVE PROCESS
S305
NO
VIOLATE RESOURCE LIMIT?
YES
S700
PROCESS FOR RESOURCE LIMIT VIOLATION
S306
ALREADY FORCED TO TERMINATE?
YES
NO
S307
NOTIFY ERROR
S308
NO
EXECUTION OF INTERMEDIATE CODE PROGRAM COMPLETED?
YES
END

FIG. 12

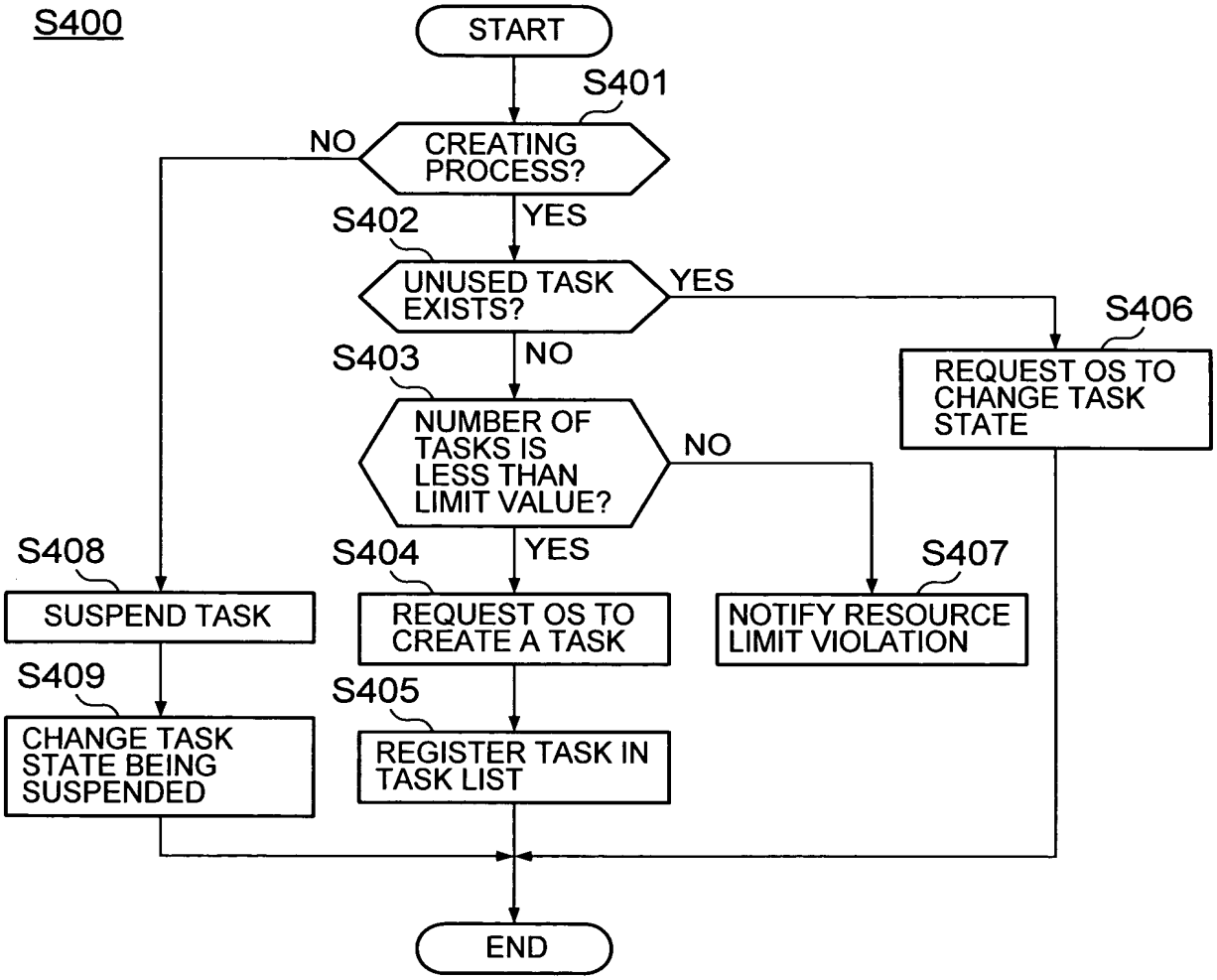

S400
START
S401
CREATING PROCESS?
NO
YES
S402
UNUSED TASK EXISTS?
YES
S406
REQUEST OS TO CHANGE TASK STATE
S403
NO
NUMBER OF TASKS IS LESS THAN LIMIT VALUE?
NO
S408
S404
YES
S407
SUSPEND TASK
REQUEST OS TO CREATE A TASK
NOTIFY RESOURCE LIMIT VIOLATION
S409
S405
CHANGE TASK STATE BEING SUSPENDED
REGISTER TASK IN TASK LIST
END

FIG. 13

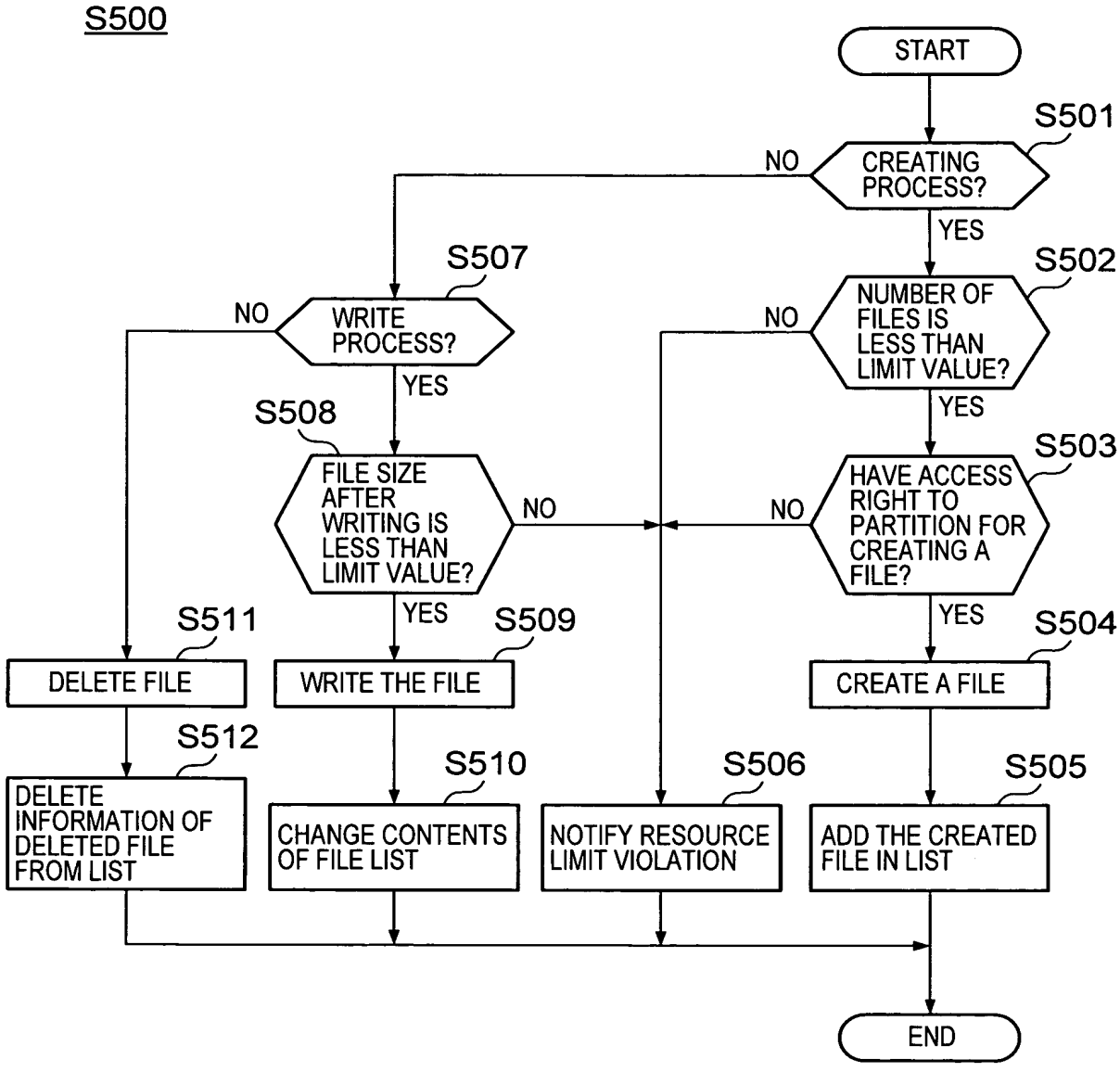

S500
START
S501
CREATING PROCESS?
NO
YES
S502
NUMBER OF FILES IS LESS THAN LIMIT VALUE?
NO
YES
S503
HAVE ACCESS RIGHT TO PARTITION FOR CREATING A FILE?
NO
YES
S504
CREATE A FILE
S505
ADD THE CREATED FILE IN LIST
S506
NOTIFY RESOURCE LIMIT VIOLATION
S507
WRITE PROCESS?
NO
YES
S508
FILE SIZE AFTER WRITING IS LESS THAN LIMIT VALUE?
NO
YES
S509
WRITE THE FILE
S510
CHANGE CONTENTS OF FILE LIST
S511
DELETE FILE
S512
DELETE INFORMATION OF DELETED FILE FROM LIST
END

FIG. 14

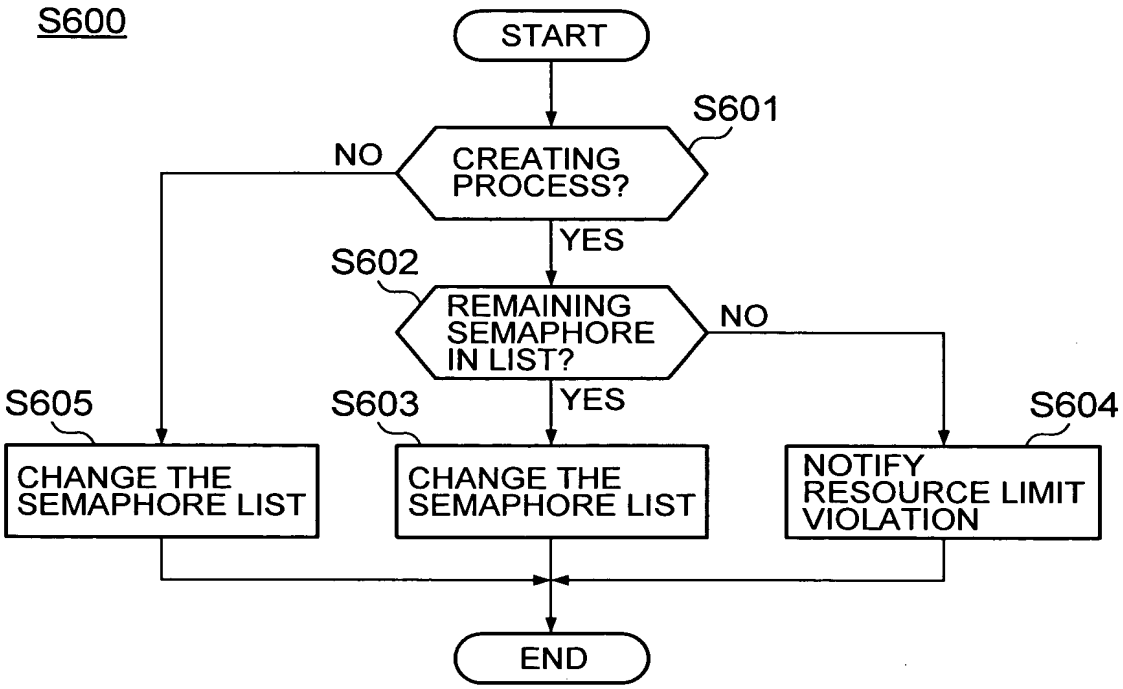

S600
START
S601
CREATING PROCESS?
NO
YES
S602
REMAINING SEMAPHORE IN LIST?
NO
YES
S605
S603
S604
CHANGE THE SEMAPHORE LIST
CHANGE THE SEMAPHORE LIST
NOTIFY RESOURCE LIMIT VIOLATION
END

FIG. 15

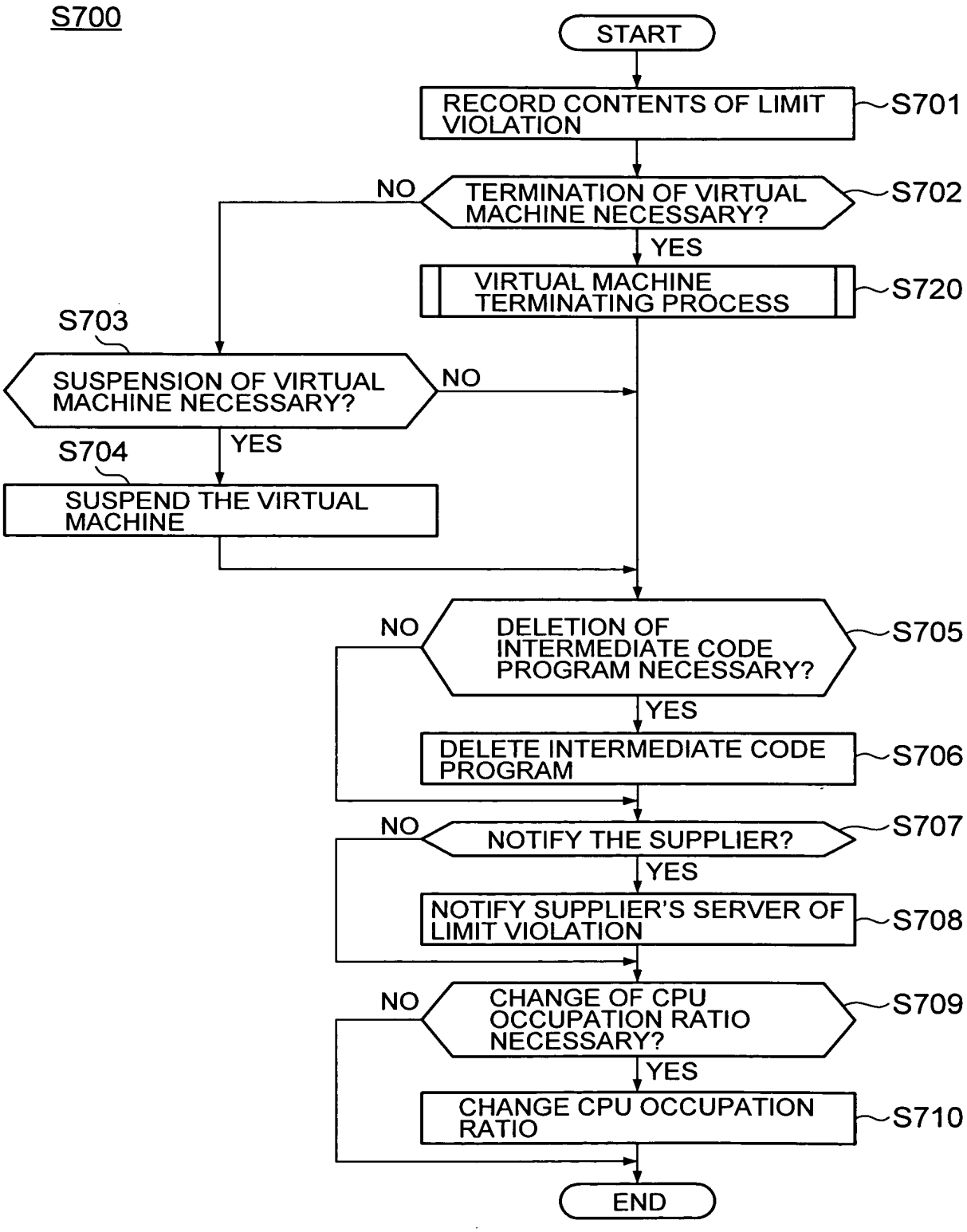

S700
START
RECORD CONTENTS OF LIMIT VIOLATION
S701
NO
TERMINATION OF VIRTUAL MACHINE NECESSARY?
S702
YES
VIRTUAL MACHINE TERMINATING PROCESS
S720
S703
SUSPENSION OF VIRTUAL MACHINE NECESSARY?
NO
YES
S704
SUSPEND THE VIRTUAL MACHINE
NO
DELETION OF INTERMEDIATE CODE PROGRAM NECESSARY?
S705
YES
DELETE INTERMEDIATE CODE PROGRAM
S706
NO
NOTIFY THE SUPPLIER?
S707
YES
NOTIFY SUPPLIER'S SERVER OF LIMIT VIOLATION
S708
NO
CHANGE OF CPU OCCUPATION RATIO NECESSARY?
S709
YES
CHANGE CPU OCCUPATION RATIO
S710
END

FIG. 16

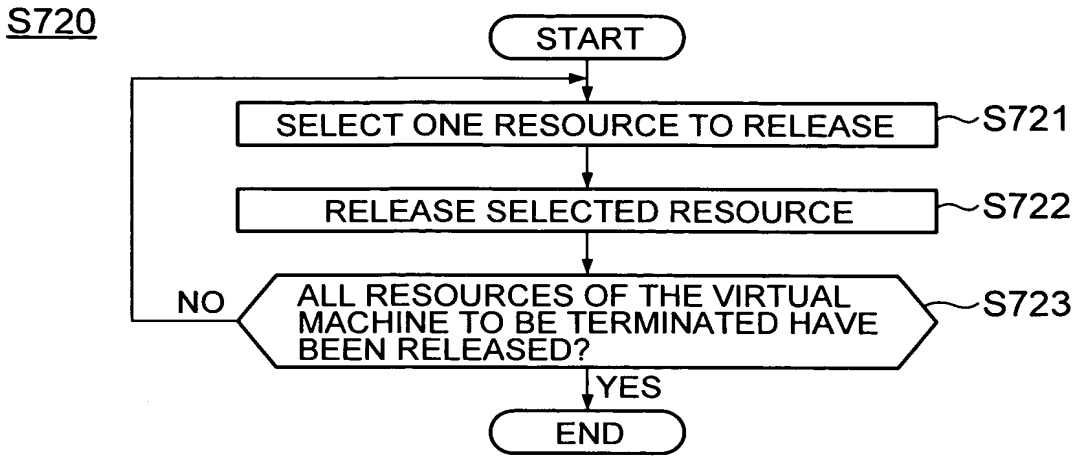

S720
START
SELECT ONE RESOURCE TO RELEASE
S721
RELEASE SELECTED RESOURCE
S722
NO
ALL RESOURCES OF THE VIRTUAL MACHINE TO BE TERMINATED HAVE BEEN RELEASED?
S723
YES
END

FIG. 17

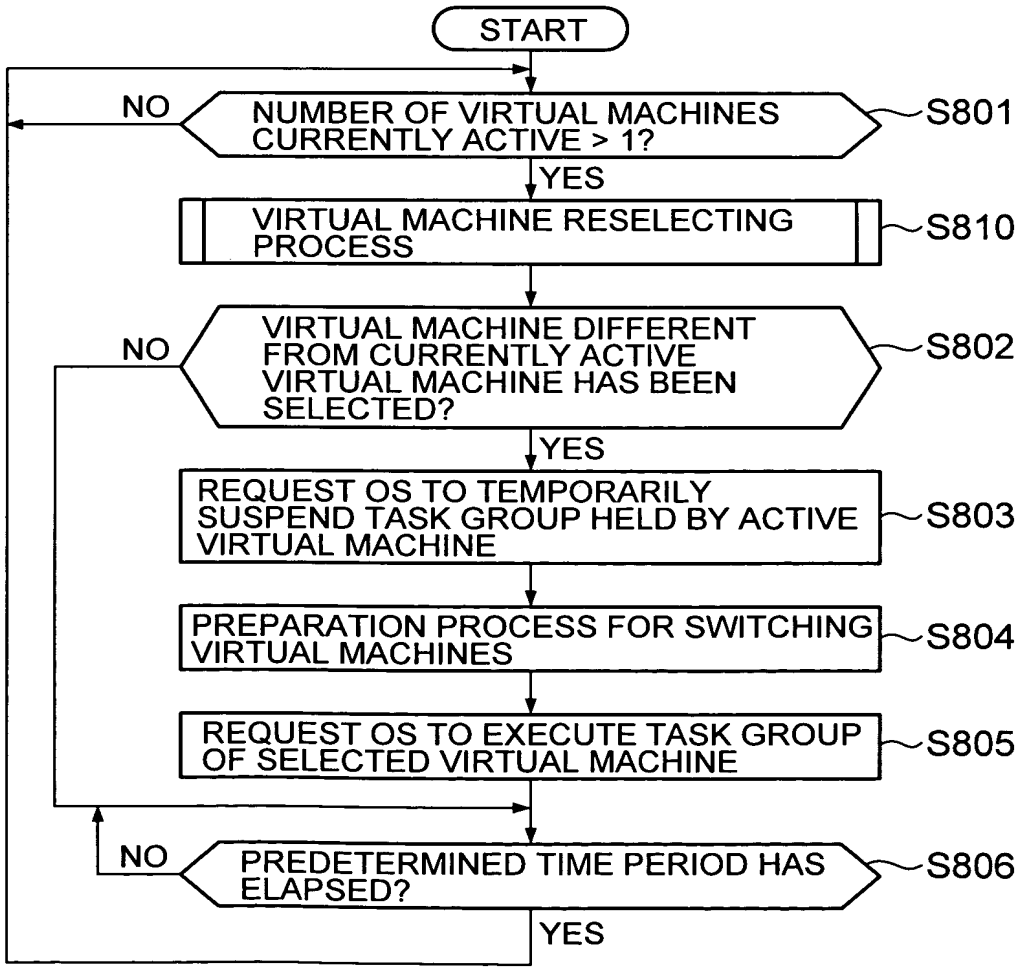
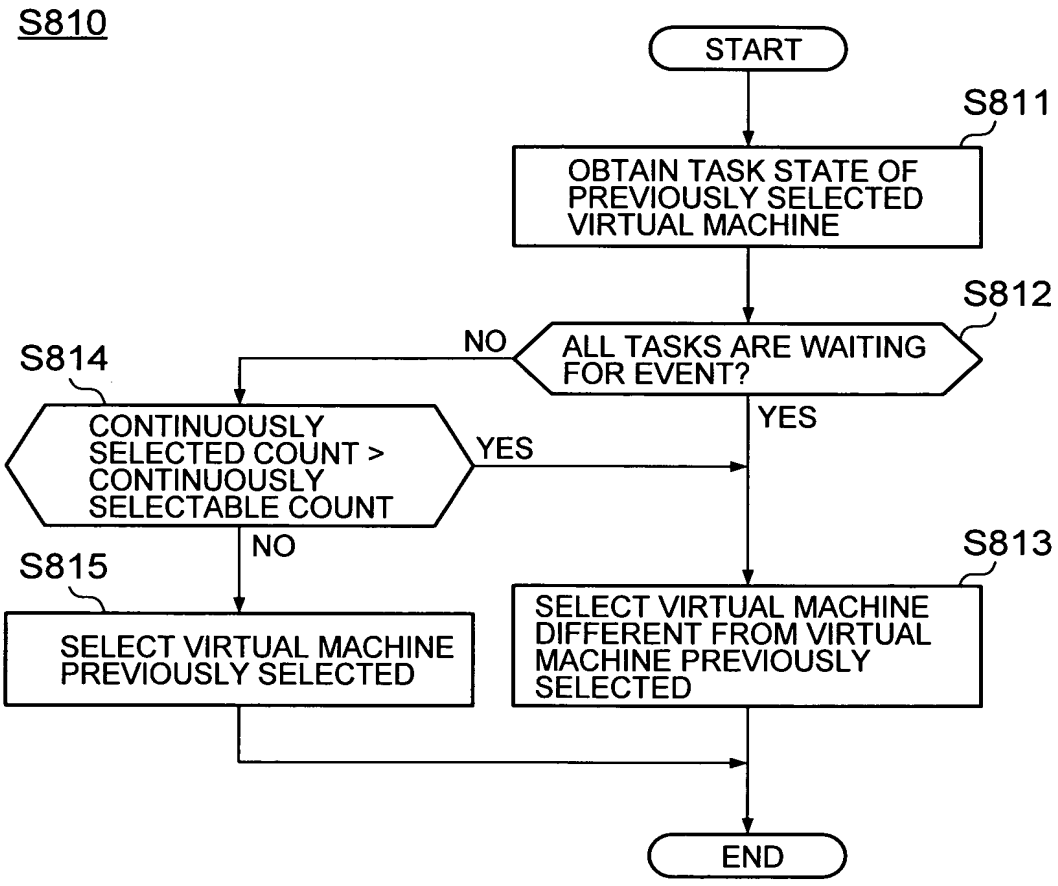

START
NO
NUMBER OF VIRTUAL MACHINES CURRENTLY ACTIVE > 1?
S801
YES
VIRTUAL MACHINE RESELECTING PROCESS
S810
NO
VIRTUAL MACHINE DIFFERENT FROM CURRENTLY ACTIVE VIRTUAL MACHINE HAS BEEN SELECTED?
S802
YES
REQUEST OS TO TEMPORARILY SUSPEND TASK GROUP HELD BY ACTIVE VIRTUAL MACHINE
S803
PREPARATION PROCESS FOR SWITCHING VIRTUAL MACHINES
S804
REQUEST OS TO EXECUTE TASK GROUP OF SELECTED VIRTUAL MACHINE
S805
NO
PREDETERMINED TIME PERIOD HAS ELAPSED?
S806
YES

FIG. 18


S810
START
S811
OBTAIN TASK STATE OF PREVIOUSLY SELECTED VIRTUAL MACHINE
S812
ALL TASKS ARE WAITING FOR EVENT?
NO
YES
S814
CONTINUOUSLY SELECTED COUNT > CONTINUOUSLY SELECTABLE COUNT
YES
NO
S815
SELECT VIRTUAL MACHINE PREVIOUSLY SELECTED
S813
SELECT VIRTUAL MACHINE DIFFERENT FROM VIRTUAL MACHINE PREVIOUSLY SELECTED
END